

**THE LIFE HISTORY OF THE HAWK MOTH *MACROGLOSSUM
INSIPIDA PAPUANUM* ROTHSCHILD & JORDAN, 1903
(LEPIDOPTERA: SPHINGIDAE).**

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Abstract

The egg, larval instars and pupa of *Macroglossum insipida papuanum* Rothschild & Jordan are described in detail. The larval food plant is *Spermacoce latifolia* Aubl., 'square stem' (family Rubiaceae). Notes on biology are provided, including on two parasitoid fly species (family Tachinidae).

Introduction

Macroglossum insipida papuanum Rothschild & Jordan occurs in Australia from the islands of Torres Strait to Mackay and in Papua New Guinea, where it is distributed throughout the Louisiade Archipelago and the southern mainland (Moulds 1985). The nominate subspecies has a much wider distribution, from India to China and the Andaman Islands, Sri Lanka, Malaysia and Indonesia. There are no other recognized subspecies. Adults are not often encountered, mainly because they are rarely attracted to light.

The final instar larva and pupa of *M. i. insipida* Rothschild & Jordan were described by Mell (1922) and Bell and Scott (1937), while Dupont and Roepke (1941) added brief descriptions of the early instars. Holloway (1987) summarised the larval descriptions of the preceding authors.

Mell (1922) listed the food plant from China as *Hedyotis auricularia* (= *Oldenlandia auricularia*) (family Rubiaceae); Bell and Scott (1937) listed *Spermacoce hispida* (family Rubiaceae) and *Corchorus capsularis* (family Tiliaceae) from India; Dupont and Roepke (1941) listed *Borreria latifolia* (family Rubiaceae) from Java, while Mathur and Singh (1960) listed *Memecylon* (family Melastomataceae) from India. The early stages and food plant of subspecies *M. i. papuanum* have not been recorded previously. Below we describe all the early stages and record a new food plant.

Life history

Larval food plant. The hostplant, *Spermacoce latifolia* Aubl., 'square stem' (family Rubiaceae), is a semi-prostrate, naturalized weed often found tangled among grass and other weeds.

Egg (Figs 1a-b). Very pale yellow, almost white; glossy; under moderate magnification (x 50) a very fine, net-like surface reticulation can be seen; subspherical, 1.33 mm long x 1.23 mm wide x 1.17 mm high. Developmental time about 7 days. Eggs have been found during June.

Larva (Figs 1c-f, 2a-c). First instar (Fig. 1c): slender in build; glossy; pale yellow on hatching becoming mostly light green after feeding; without markings; head yellow; legs, ventral prolegs, claspers and anal plate all pale yellow; tumidity at base of horn sometimes with a slight hint of reddish brown; primary setae very fine and simple. Caudal horn jet black; not glossy; straight; gradually tapering; length of horn 1.5 mm and not appearing especially long; apex bifurcate, the conical branches set in a 'V' shape, each terminating in a long fine seta; surface of horn with numerous short, fine, black setae visible only under magnification. Length of mature larva at rest approximately 7 mm. Width of head capsule approximately 0.77 mm. Duration of instar about 3.5 days.

Second instar (Fig. 1d): similar to first instar but head light green and, with maturity, developing numerous very faint and indistinct dull white spots marking low tubercles visible under magnification (x 25) and an indistinct subdorsal dull white stripe from head to base of caudal horn. Caudal horn jet black with a little yellowish brown at base; very gently curved forwards, 2.4 mm long, bifurcation slightly wider than distal part of shaft; throughout its length bearing many very small black conical tubercles clearly spaced apart, each bearing a simple black seta as long or a little longer than the tubercle. Length of mature larva at rest approximately 11.0 mm. Width of head capsule approximately 1.06-1.07 mm. Duration of instar about 3 days.

Third instar (Fig. 1e): body pale lime green; non glossy; a subdorsal pale yellow stripe from head to caudal horn; thoracic and abdominal segments bearing numerous white dots (low tubercles) in transverse rows, mostly on dorsal and lateral surfaces. Head dull lime green, antennal bases pale brown, mouthparts green except for pale brown mandibles with dark brown apices. Prothoracic shield inconspicuous, colouration and marking similarly to thorax. True legs pale green tending slightly pale brown distally, ventral prolegs similar in colour to abdomen but with distal portion tending pale, claspers (anal prolegs) lime green. Spiracles inconspicuous, pale orange brown. Anal plate similar in colour to body. Caudal horn brown tending black, lacking reddish brown at base, instead a little smoky pale brown laterally at extreme base; approximately 3.3-3.5 mm long; curved forwards in a shallow arc; throughout its length bearing many, very small, black tubercles spaced apart; apex of horn barely bifurcate, the branches spread no wider than distal part of shaft. Length at maturity approximately 15 mm. Width of head capsule approximately 1.5 mm. Duration of instar approximately 5 days.

Fourth instar (Fig. 1f): body lime green, paler dorsally; non glossy; a subdorsal, pale yellow stripe from head to base of caudal horn, this stripe narrowly edged above by a narrow green stripe that is for the most part not clearly defined; thoracic and abdominal segments bearing numerous white dots (low tubercles) in transverse rows, mostly on dorsal surface, less so laterally and sparsely so on ventral surface. Head dull lime green but with

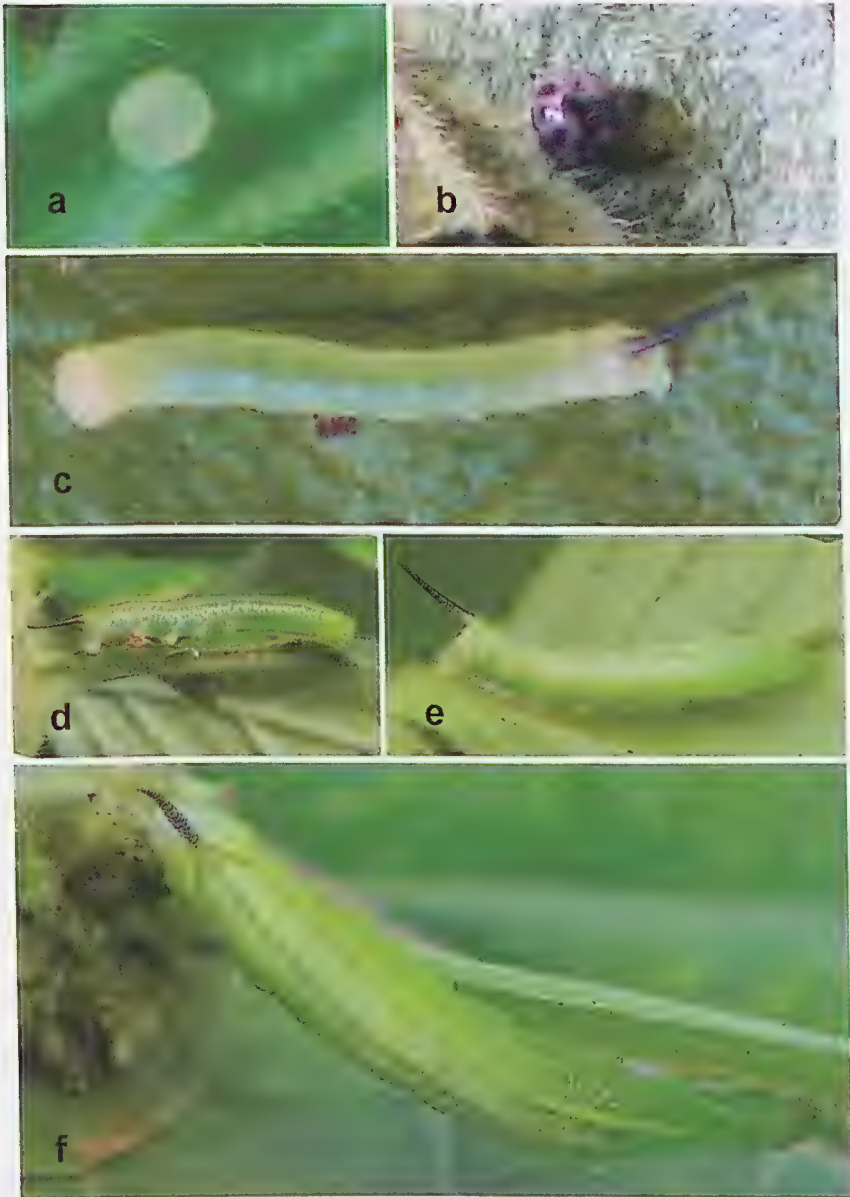


Fig. 1. *Macroglossum insipida papuanum* (images not to scale): (a) egg; (b) egg parasitized by a wasp of unknown family; (c) first instar larva; (d) second instar larva; (e) third instar larva; (f) fourth instar larva.

very indistinct paler vertical stripes, one down each side of midline and one down each cheek; antennal bases pale brown; mouthparts green except for pale brown mandibles with dark brown to black apices. Prothoracic shield similarly coloured and marked to thorax showing the continuation of the dark midline and pale subdorsal stripes. Spiracles inconspicuous, orange brown minutely capped white above and below. True legs glossy, pale green; ventral prolegs similar in colour to abdomen; claspers lime green becoming pale distally. Anal plate similar in colour to body, lateral margin partly pale. Caudal horn pale purplish to light pinkish brown with distal third or so always fading to light yellow; slender, approximately 4.0 mm long, gradually tapering to a blunt point, curved forwards in a shallow arc; throughout its length bearing many small tubercles, clearly spaced apart, mostly black but some similarly coloured to that part of the horn upon which they are situated especially on yellow distal portion. Length of mature larva at rest approximately 26+ mm. Width of head capsule approximately 1.8-1.9 mm. Duration of instar about 5 days.

Fifth instar (Figs 2a-c): considerably variable in colour between individuals with background pigmentation ranging from yellowish green, through yellowish brown to dark brown to almost black (but note that brown larvae are greenish before attaining their brown coloration some hours after ecdysis). Thoracic and abdominal segments with dorsal midline marked by a black line, sometimes broken and partly ill-defined; a black subdorsal stripe from head to base of caudal horn, sometimes ill-defined; often a dull yellow stripe immediately below the black subdorsal stripe, clearest on thoracic segments and abdominal segment 8; numerous, very small, pale spots distributed over much of body, pale yellow or white in colour, on some larvae some of these pale spots partly or completely circled by dark brown or black and with similar pigmentation filling some gaps between; eight oblique, lateral stripes spaced evenly across metathorax and abdominal segments 1-8, black or dark brown in colour but not always clearly defined, the lower end of each stripe anterior and starting at or near the junction between two segments, each stripe then running backwards up to meet or almost meet the subdorsal black stripe; much of lateral area below each oblique stripe also black or dark brown forming a lateral row of somewhat triangular markings. Spiracles indistinct, rust-brown in colour. Head black or dark brown, bearing four vertical dull green or greenish brown stripes more or less evenly spaced dull green or brown; mouthparts a mixture of green and brown with black apices to mandibles. Thoracic legs light brown; ventral prolegs, claspers and anal plate all similar in colour to adjacent body, often dark. Caudal horn brown to nearly black with pinkish or orange apical quarter or more; of medium length (approximately 4.1-4.8 mm); straight or barely curved backwards; clearly tapering throughout its length to a pointed apex; bearing numerous, short spine-like tubercles directed backwards, mostly black but those on coloured apical portion nearly all similar in colour to that part of

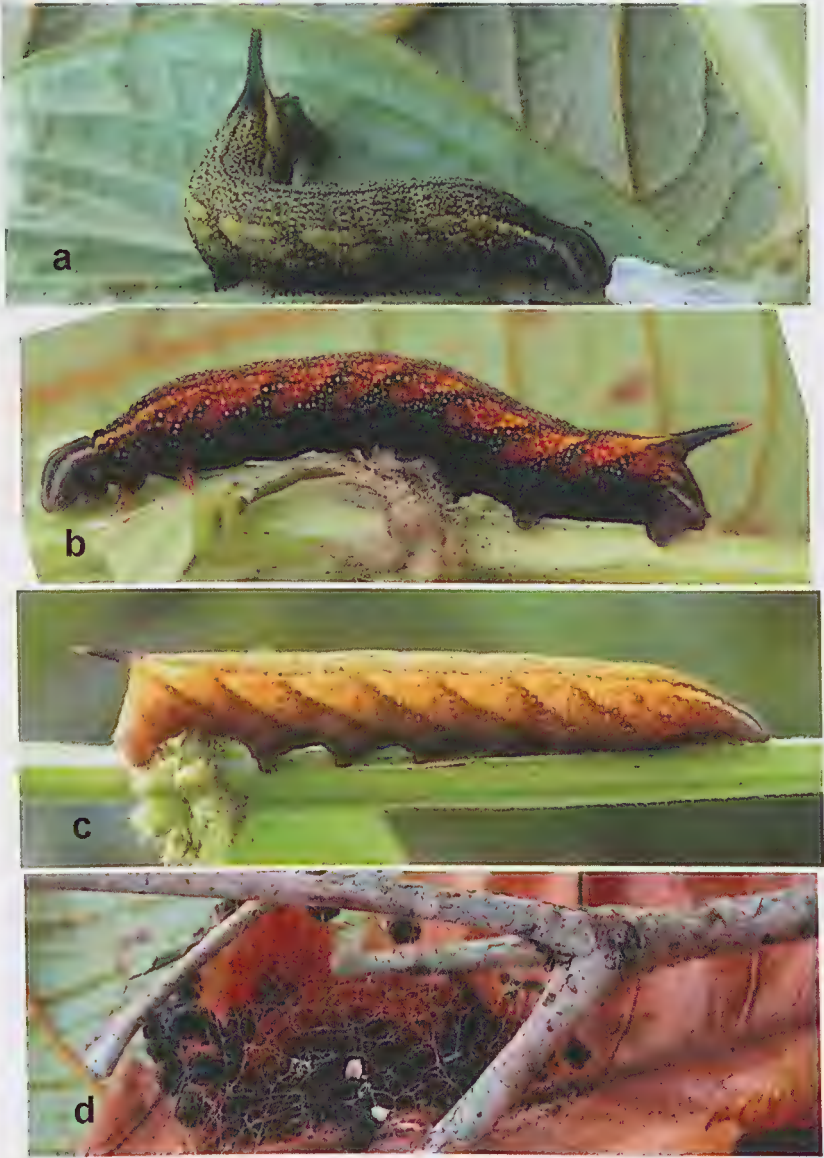


Fig. 2. *Macroglossum insipida papuanum*: (a) fifth instar larva, green form; (b) fifth instar larva, dark brown form; (c) fifth instar larva, light brown form; (d) larval shelter spun prior to pupation.

horn. Length of mature larva at rest approximately 37 mm. Width of head capsule approximately 2.6-2.9 mm. Duration of instar about 6-7 days.

Pupa (Figs 3a-b). Semi-glossy; light yellowish brown with some black mottling and other black markings. Thoracic and abdominal spiracles black, accentuated by jet black blotches; thoracic segments with a jet black dorsal midline clearly defined; thoracic segments sparsely marked with black spots or small blotches; abdominal segments closely spotted black and usually one or two segments substantially blackened dorsally. Head with a distinct black dorsal midline on anterior half adjoining proboscis, this mark uneven in width; proboscis moderately keel-shaped in front and below head, light brown on expanded keel, thereafter midline black to apex; antennae light brown, sometimes with sparse fine black spotting. Forewings light brown with some irregular scattered black spotting. Legs light brown with irregular black spotting. Cremaster flat, long, in general shape somewhat resembling a duck's bill; usually slightly upturned towards apex; apex truncate with a very small, thin spine-like projection at either corner directed backwards; dorsal surface smooth, glossy; ventral surface moderately concave, basally ribbed on midline terminating before mid length. Length approximately 28-32 mm. Width at widest point approximately 8.0-8.5 mm.

Notes on biology

Eggs are laid individually on the undersides of leaves of the larval food plant. Prior to pupation, the larva spends about a day constructing its pupal refuge, weaving a golden-coloured open netting around itself (Fig. 3d), pulling leaves and sticks into the construction as it progresses, as well as other bits of debris and frass. The larva rests within this shelter and pupates about two days later.

Adults can be found feeding on the flowers of *Lantana*, *Ixora*, *Calliandra riparia* and *Asystasia gangetica* at dusk and are rarely attracted to light. Adults have been collected from January to June.

Dipteran parasitoids

Larvae are parasitized by flies of the genera *Blepharipa* Rondani and *Pallexorista* Townsend (family Tachinidae). *Blepharipa* (Fig. 3c) lays minute eggs on host foliage. When the host larvae accidentally ingest the eggs they hatch and the first instar larvae penetrate the gut wall of the host and feed on internal tissue. The fly larvae take longer to develop than the host larva and normally emerge from the host pupa, whereupon they bury themselves in debris or loose soil to pupate. The flies normally remain in the pupal stage for about 3 weeks.

Pallexorista are ovoid-oviparous, laying eggs containing fully developed first instar larvae which seek out a host. Three fly larvae emerged from one fully mature *M. insipida* larva about to pupate and proceeded to consume every bit of the larva, including the anal horn, before they pupated.

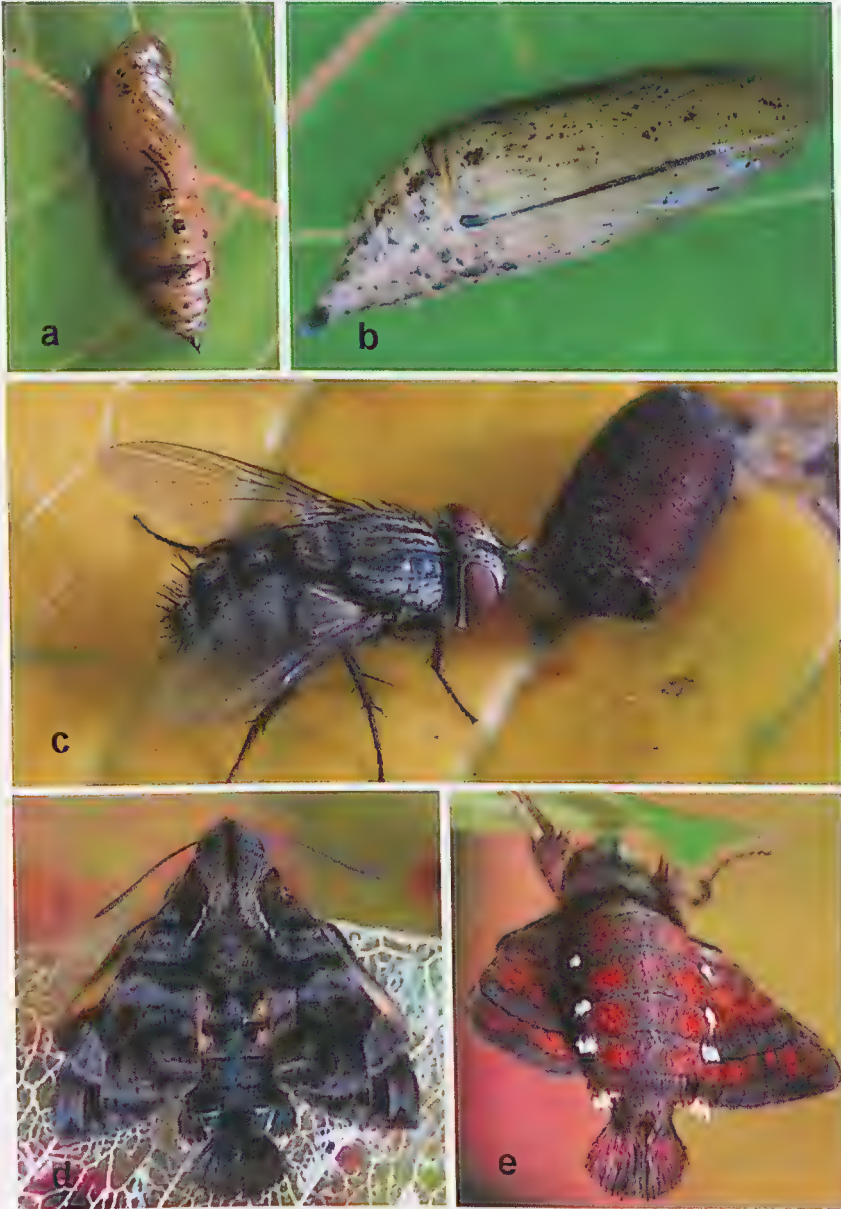


Fig. 3. *Macroglossum insipida papuanum* (images not to scale): (a) pupa, lateral view; (b) pupa, ventral view; (c) tachinid fly parasitoid, *Blepharipa* sp., newly emerged from its puparium; (d) live adult, dorsal view; (e) live adult, ventral view.

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References

- BELL, T.R.D. and SCOTT, F.B. 1937. Moths. Sphingidae. In: *The fauna of British India including Ceylon and Burma*. Volume 5. Taylor & Francis, London; 537 pp, 15 pls. [Facsimile reprint, 1976, Today and Tomorrow's New Delhi.]
- DUPONT, F. and ROEPKE, W. 1941. Heterocera Javanica. Fam. Sphingidae, hawk moths. *Verhandelingen der Nederlandsche Akademie van Wetenschappen. Tweede Sectie* 40(1): 1-104, pls 1-23.
- HOLLOWAY, J.D. 1987. *The moths of Borneo. Part 3. Lasiocampidae, Eupterotidae, Bombycidae, Brahmaeidae, Saturniidae, Sphingidae*. Southdene Sdn. Bhd, Kuala Lumpur; 199 pp, figs 6-163, 20 pls.
- MATHUR, R.N. and SINGH, B. 1960. A list of forest pests in India and adjacent countries. Part 7. List of insect pests of plant genera 'L' to 'O'. *Indian Forest Bulletin (N.S.), Entomology* 171: 1-148.
- MELL, R. 1922. *Beiträge zur Fauna Sinica (II). Biologie und Systematik der südchinesischen Sphingiden*. Friedlander & Son, Berlin; 311 pp, atlas.
- MOULDS, M.S. 1985. A review of the Australian hawk moths of the genus *Macroglossum* Scopoli (Lepidoptera: Sphingidae). *Australian Entomological Magazine* 12(5): 81-105.